Chapter 19

The CD Research Surge

The management problem presented to me when I arrived in September 1961 was awesome. The emergency appropriation that President Kennedy had teased out of Congress included about $14 million for research. That doesn't sound like much these days but back then it was equivalent of about $200 million today. The OCDM had budgeted only about $600,000 for research, most of which wasn't really research. So, I would have to find scientists and engineers that could do the research, most of whom would be found in universities and private companies, invite proposals and let contracts through the Pentagon procurement system. And, because the money was part of an emergency appropriation, it had to be committed before the end of the fiscal year; namely, June 30, 1962, just 9 months away.

Fortunately, I knew what research had to be done, at least in general terms. In my last days at NRDL, I had roughed out a research program that was based on all of my experience during the 1950s. I structured the program around my countermeasures system study. I ended up with four major divisions in the work. The first was devoted to research on shelters, the central countermeasure in the emergency phase. The second division addressed the other emergency functions in support of shelter, such as warning, firefighting, rescue and medical aid. Next came research on the recovery phase, which I called Postattack Research. Finally, I envisioned work on systems studies, which would put all the foregoing research together as well as provide background upon which to base civil defense operational planning.

Within each of these major divisions I created a second-level breakdown to more specific areas of study. These are shown in Table 1. Also shown in the table are the four-digit codes that were used subsequently to identify work units. That is, all work on shelter protection studies were to be in the 1100 series. An actual example is 1135A, which was a contract with the Illinois Institute of Technology Research Institute (IITRI) to conduct full-scale tests of basement shelters against building fires. I don't intend to bore you with much of this nitty-gritty detail. Suffice it to say that such detail is part of what it means to conduct a contract research program, which was my fate for the next 12 years.

Despite the urgency of my situation and the plush environment of life on the E Ring, I did not look forward to being simply a program manager, a Pentagon bureaucrat. I resolved to acquire a good staff and organize it so I could continue to devote about a quarter of my time to my own original research. If I could do that, I felt I could avoid becoming just another bureaucrat, filling out budget documents and going from one meeting to the next. Looking back, I realize I was successful.

But first I needed a staff. Most of the employees of the now-defunct Office of Civil and Defense Mobilization had been transferred *en masse* to the Department of Defense and I was told by Bob Holt that about 30 of them were now mine. They were, of course, in Battle Creek, Michigan, where OCDM had been headquartered. How many of them were

Table 1

Civil Defense Program Elements

	Work Unit Series
SHELTER RESEARCH	
Protection Studies	1100
Shelter Environment Studies	1200
Subsistence and Habitability Studies	1300
Prototype Life Support systems	1400
Shelter Management Studies	1500
Shelter System Studies	1600
Development and Test	1700
SUPPORT SYSTEMS RESEARCH	
Monitoring Studies	2100
Communications and Warning Studies	2200
Reduction of Vulnerability	2300
Emergency Medical Studies	2400
Fire Effects and Protection	2500
Emergency Operations Research	2600
POST-ATTACK RESEARCH	
Radiological Phenomena & Effects	3100
Radiological Countermeasures	3200
Repair and Reclamation	3300
Post-attack Medical, Health & Welfare	3400
Post-attack Systems Studies	3500
SYSTEMS EVALUATION	
Civil Defense Systems Analyses	4100
Strategic Analyses	4200
Vulnerability Studies	4300
Organization and Training Studies	4400
Planning Support Research	4500
Information Systems Studies	4600
Physical Environment Studies	4700
Social and Psychological Studies	4800

willing to follow their jobs to the Washington area I had not a clue. It would be an uprooting for many of them just as it was for my own family. A few days after I got my program approved by Steuart Pittman, I took a plane to Battle Creek.

To say that "my people" were glad to see me would be an understatement. They were just glad that someone remembered they existed. Some had left for other jobs but the ones I talked to were willing and anxious to move to the Washington area. The most senior among them was a distinguished engineer approaching retirement age by the name of Arthur Morrell. He set me up with a suitable conference room and fed the staff to me one at a time.

I did a series of one-on-one interviews with each employee I had inherited. It turned out that I knew only one of them, Wayne Johnson, who had been the OCDM representative on my shelter living experiments. I didn't know him very well. So I asked them all for a resumé and spent some time learning of their interests and recent experience. I found several quite solid staff members that I thought could handle parts of the contract research effort.

For example, Art Morrell sent in Frank Allen, a mechanical engineer. I asked Frank what research contracts he was presently supervising. He was responsible for only one, a small effort at the National Bureau of Standards to determine experimentally the heat capacity of the ground surrounding a buried shelter structure, costing $30,000. Since the new civil defense program was using existing buildings to provide fallout shelter, this would not be high on my priority list but it would contribute to understanding how to ventilate many basement areas and, anyway, I was desperate to get going. I asked Frank how much we could accelerate that work. He excused himself to make a phone call and shortly returned to announce in a satisfied voice that his project could use another $10,000. "Frank," I said, "in the next six months, you and I are going to spend a half million dollars on the shelter ventilation problem. So you had better start thinking about how you are going to do that." Frank looked at me with his mouth agape. I suddenly realized that Frank Allen was having difficulty getting his mind around the concept of a half-million-dollar research effort.

After a bit, Frank's engineering training surfaced and we talked about what needed to be done. The basic problem is that each shelteree gives off the heat of a 100-watt light bulb plus moisture (called *latent heat*) and with electric power lost and a warm day, a crowded shelter area could become unlivable. Ways to provide ventilation or cooling could save lives. I sent him off to write scopes of work (the technical heart of research contracts), confident I had someone to handle Work Unit Series 1200 and 1300—and,perhaps, some of 1400 (see Table 1.)

I discovered another gem in Ralph Garrett, a tall garrulous fellow with fused back bones or something like that, which made him walk a bit like a robot. Ralph was a Morman working in the social science area. One of his previous jobs was as a Red Cross field

worker during natural disasters. He had no scientific training but one could tell after a little conversation that he had trained himself very well. He knew the people doing behavioral research in the emergency response area and they obviously accepted him. I set him to work on scopes of work for Work Unit Series 4800.

I was also pleased with Fred Carr, who turned out to be the contract supervisor on the American Institutes for Research (AIR) contract from which I had "borrowed" Dr. Bob Goldbeck for my two-week shelter stay (see Chapter 16.) Fred had already thought about expanding the shelter occupancy experiments. He had located an excellent research team at the University of Georgia. Work Unit Series 1500 would be well taken care of.

Plenty of Indians but No Chiefs

Many of the people I interviewed were business and procurement types. I would need those to take care of the paperwork and track it through the contracting process. I decided to make Wayne Johnson the office manager and teamed him up with Rita McGinley, a specialist in report production. Rita was a close friend of Frances Djac, the senior secretary of the group. Since I needed a secretary, I delighted both ladies by giving them those key jobs. Before I left Battle Creek I made Art Morrell my deputy and tasked him with getting the group to Washington and established in the Pentagon.

In a major sense the trip to Battle Creek was a disappointment. The key people I had hoped to find there were not there. I badly needed leaders, people who could serve as division heads. One of those I wanted was John Devaney. I had met John several years before in connection with the Gaither Panel and on several study panels since then. He and I got along famously, each inspiring the other. He could head the Shelter Research Division or the Systems Evaluation Division, being highly qualified in both areas. He had worked directly for Pat Gallagher but I had checked with Bob Holt and he was not on our roles. Where was he? And where were Jack Greene and Jim Buchanan? Actually, I learned quickly that Jack Greene and Jim Buchanan had chosen to remain with the Office of Emergency Planning, the remnant of OCDM not transferred to the Defense Department. OEP was charged with coordination of defense assignments to the various departments and agencies. Jack Greene, it turned out, was head of the Review and Evaluation Branch of OEP. I had never met either of these two gentlemen but from what John Devaney and others had told me I didn't think they could be satisfied with a bureaucratic job. As I note a bit later, I got them to review my program and then offered Jack the head of the Postattack Research Division; Jim, the head of the Shelter Research Division. They accepted and transferred over in February.

But wait, I'm getting ahead of my story. When I returned from my trip to Battle Creek, I was indeed disappointed that certain key people had not been there but I was happy with most I talked with. I was sure that Art Morrell would get them to the Pentagon as rapidly as possible and that the technical types were busy producing scopes of work for the research we had discussed. I was able to leave the task of acquiring office space for the influx to Bob Holt, who was very helpful. Bob introduced me to George Harbin, a young procurement officer half a head shorter than I was. George had an office in the

procurement area somewhere and I guess he wasn't in OCD but was assigned to handle the OCD procurement work. I don't believe I ever visited his office.

The single people in Battle Creek were quicker to move to the Washington area than those with families and houses. So it wasn't long before Fran Djac arrived and I said goodbye to Doris. I hope I'm spelling Fran's name correctly. It was pronounced DEEzhack. Fran was a tall, slim brunette, really a lovely girl. The job was a promotion and Fran seemed to know the Pentagon procedures when she came in the door. Maybe there was a manual. Soon, there was a bustle of people in the outer office although only a few were allowed to see me. At staff meetings, other directors complained about the difficulties of getting action out of Pentagon procurement but I had none. Whenever I had such a problem it seemed that George Harbin was in the outer office waiting to see me about it. I thought his eagerness to be of service was because he liked me—until he and Fran announced that they were engaged to be married!

Desperate for chiefs to help me, I called Carl Miller, who was now working at Stanford Research Institute (SRI). He agreed to take a 60-day leave of absence from SRI. I made him head of Postattack Research when he arrived in November 1961. He wrote two papers, one on postattack problems and one on fire research. They were invaluable as the basis for scopes of work.

I went to see Pat Gallagher about the whereabouts of John Devaney. Pat seemed completely at sea in the Pentagon and had been bypassed by Paul Visher, who had effectively taken over Technical Operations. Several months later, I learned he had retired. He did give me some clues that I planned to pursue but then I got so involved in the Holifield hearings and the research surge that it was summer before I renewed the search.

One day in early April 1962 I was walking down the E-Ring hall when whom should I see coming toward me but Jim Kerr. I had not seen him nor thought much about him for half a decade (see Chapter 13.) He saw me about the same time I saw him and after the shock of recognition we fell into each others arms like long-lost brothers. I took him back to my office, explaining as we walked that I had a new job and worked in the Pentagon. He in turn filled me in on his career since I last saw him as well as the good health of his wife Tommie and his four children. As we talked, I realized that Jim Kerr could very well be the missing supervisor I had been looking for. I knew he was expert in radiation detection and communications and now learned he had spent the past few years in Army training and operations. Moreover, he was available, having just been passed over for a colonelcy. In a matter of weeks, Jim Kerr was head of Support Systems Research. Thus, for at least the last quarter of the fiscal year I had pretty nearly all the Division Heads who worked with me during the next ten years: Art Morrell as Deputy; Jim Buchanan as head of Shelter Research; Jim Kerr as head of Support Systems; and Jack Greene as head of Postattack Research. I ran Systems Evaluation Division by myself, still determined to find John Devaney as the ideal candidate for that job.

Touching all the Bases

By the time of the Christmas holidays of 1961, the production of scopes of work in Battle Creek, Carl Miller's papers and the suggestions found in a 1958 evaluation of OCDM research by the Advisory Committee on Civil Defense of the National Academy of Sciences had resulted in a draft program of some 200 research projects. I had further requested research requirements from the operating elements of OCD and consulted the staff of DDRE on research efforts in other parts of the Department of Defense. I got good help from John Lynch and Bill Niskanen of the Institute for Defense Analysis (IDA) and from Herman Kahn, who was back east, breaking free from Rand Corp. and setting up his own think-tank, Hudson Institute. Also, I asked people I knew at the university institutes, not only SRI but also Research Triangle (RTI), MIT (MITRE), and Illinois Institute of Technology (IITRI).

Just before going home to Los Altos for Christmas, I briefed Harold Brown and members of the DDRE staff and got the program approved. After the holiday break, I submitted the program for review to the Advisory Committee on Civil Defense of the National Academy of Sciences. This distinguished committee was chaired by Dr. Lauriston S. Taylor, head of the Radiation Physics Division of the National Bureau of Standards. Among the dozen members of the committee was my former boss at NRDL, Dr. Paul Tompkins, now head of the Division of Radiological Health of the Public Health Service.

The real work of the Advisory Committee was done by seven subcommittees and working groups, some chaired by members of the committee. I was heartened to find a number of people I knew on these subcommittees, including several who had worked with or for me at NRDL; namely, Carl Miller and Charlie Ksanda on the working group on fallout models, Bill Kreger on the radiation shielding subcommittee and Stan Martin on the fire spread working group. But what really knocked me out was to find that Jack Greene and James Buchanan were members of every subcommittee and working group as representatives of OEP! They were reviewing my research program! They must have liked what they saw because my appointment book shows that Jack Greene came to see me at 10 am on the 16th of January 1962. He and Jim Buchanan came to work a month later.

The Beginning of the Surge

By the time of the Holifield hearings of February 1962, I was able to testify that about $3 million was under contract and another $5 million was in the contracting process. I need to explain what was meant by "the contracting process." Briefly, we prepare a Request for Proposal (RFP), of which the "scope of work" I've already mentioned is an important part. The RFP is published by the contracting officer (in our case, George Harbin) in a sort of daily newspaper that research organizations pore over for new work. Interested research organizations are given a deadline for submission of proposals for doing the work. When the deadline passes, the contracting officer sends the valid proposals to us for review. All things being equal, the low bidder gets the contract but in

research things are never equal. One proposer often displays superior understanding of the nature of the problem and offers a more promising approach than do competitors of lower price. So, I set up a board to review the proposals, select the best and prepare a justification in event the winner is not the low bidder. The contracting officer then executes the contract and I assign a staff member as project officer.

You can imagine my workload about the time of the Holifield hearings. Most of my people from Battle Creek were now in the Pentagon, thank goodness, but there were still not enough chiefs. So I chaired the review of every set of proposals, along with the writer of the RFP, the writer of the scope of work, if different, Art Morrell, my deputy, and anyone else having knowledge of the field. When Jack Greene and Jim Buchanan came in, I could turn over much of the work of rating the proposals to them.

One of the things we had going for us was that we were in the process of greatly expanding the prior research effort. Thus, when we encountered two excellent proposals to an RFP or a good low bidder and a better higher bidder, we could consider contracting with both proposers, especially if the approaches to the problem were likely to be different. Another advantage that helped us was frequent unsolicited proposals; that is, proposals to do research for which we had not issued an RFP. Many of these proposals were manifestly incompetent or inappropriate but some were clearly central to one of our program topics. These were quickly brought to contract.

Based on the first $3 million "put to bed," the proportion of research effort obtained from various sources was 21 percent from the military (like NRDL), 14 percent from other government (like National Bureau of Standards), 13 percent from universities and the remainder (52 percent) from private research groups. I don't have records for the whole surge. These statistics are from the February 1962 Holifield hearings.

Nothing would be more boring than a recitation of such statistics over the course of the first few years of the 1960s. What I will do instead is describe a number of research projects of which I am especially proud and introduce a few of the researchers who did some very fine work. But first, I need to summarize the results of the surge. On Friday, the first day of June, 1962, a full month before the end of the fiscal year, I attended a meeting of the National Academy of Sciences Advisory Committee on Civil Defense. I don't remember the nature of the meeting. But I do remember that when I got back to the Pentagon that afternoon, Wayne Johnson was waiting to tell me that the last research contract in our budget had gone to Procurement for execution. We had "put to bed" all of our $14 million!

Then came the surprise. On the following Monday, Troy McKinney, our Comptroller, came to see me. "Jerry," he said, Bill Durkee is not going to be able to obligate all the money in his budget by the end of the month. The boss does not want that money to go to waste. Can you use another $2 million for research?"

"Sure," I replied. Then I summoned my division heads. We quickly concluded that the short deadline did not permit new contracts or at least not many. What we did was to

review the progress of the earliest contracts that we had let. Where the work looked promising, we wrote up a contract extension that funded the project for an additional year. And Troy McKinney kept coming back with additional funds available. By the end of the fiscal year we had obligated over $19 million dollars in the civil defense research effort!

The Ventilation Story

Remember my description of Frank Allen's reaction when I told him we were going to invest half a million dollars in shelter ventilation research? We did—and more in subsequent years—and Frank Allen supervised most of this work. Why did we do this work? For one thing, the number of people one could assign to, say, a building basement (the number of shelter spaces) depended on the shelter environment. For air quality and temperature control, commercial electric power could not be counted upon and building ventilation systems often would not have the capacity to cool the number that might be sheltered. The problem would be most severe in summer but could be of concern year round in the South in areas where good shelters were scarce.

For another thing, the amount of drinking water that might need to be stocked depended on temperature control. Only one gallon of water per person per day would be needed at an air temperature of 70 degrees. Double that is needed at 80 degrees. Three and a half gallons per person per day is needed at 90 degrees.

Among the first research contracts let were several to build artificial people (devices that gave off the heat and moisture that a person would in the test environment) and go out to identified shelters in buildings around the country to gather data. My shelter in California was one tested with 100 artificial people in it. Early results indicated that natural ventilation through open doors and windows was rarely sufficient.

We also let contracts for people-powered ventilation devices. One of the obvious possibilities was a bicycle-like pedal-operated fan. Since it would have to be pedaled inside the shelter area, it blew the shelter air through a plastic tube to a point outside the shelter. One good innovator we found in this area was Gilbert Engholm. Gil could put together demonstration prototypes very quickly and modify them based on test experience. He changed jobs twice and we followed him, so to speak.

One of the difficulties with contract research is that while the objective is to get the best possible people to work on the problem the contract has to be let to an organization. If a researcher who was outstanding or "up to speed" on one's problem changes jobs, one has to cautiously follow him—cautiously because all the contractual legalisms recognize organizations but not individuals. Some outstanding individuals chose to form their own opganizations. Herman Kahn decided to leave RAND and form Hudson Institute in 1962, just as I got started. Somewhat later, Dr. Stanley Martin, whom I knew from years at NRDL formed Martin and Associates. On the other hand, many large organizations used their best people to write proposals. Thus, one might receive an excellent proposal, yet

have no clue as to who might be assigned to carry out the work. In these cases, we did our best to get at least the project leader specified in the contract.

As to shelter ventilation, the breakthrough solution came out of the blue in the form of Cresson Kearney. Cresson was a peculiar genius who had spent much of his life in tropical climes and had some repute in jungle warfare. He was vainly trying to get the Army to outfit properly the troops they were beginning to send to Viet Nam when he got hooked on civil defense. He was outstanding in the design of expedient fallout shelters and later wrote an excellent book on do-it-yourself civil defense. For us, he simply pointed out that the peasants of Southeast Asia had solved our problem centuries ago. I forget what he said it was called in Siam but we called it "the Kearney pump."

The best way to explain the Kearney pump is to imagine one in your own home. Find a window screen that fits in the upper half of the front door opening. Tear a sheet into strips about 6 inches wide. Pin a strip of cloth across the bottom part of the window screen by the top of the strip so it just covers the lower six inches of screen. Pin another strip by the top edge across the screen about five inches further up (so there is a little overlap with the lower strip.) Keep doing this until the screen is covered. Now, hang the screen in the doorway with hooks and eyes so that the side with strips is outside. Fasten a pull string to the bottom of the screen on the inside. When you pull the swinging screen toward you, the flaps will open up but when you let it swing back out the flaps will press against the screen and push air out. Since heat rises, the air forced out is stale warm air while the air replacing it flowing in the bottom of the doorway is fresh cooler air. Cool!

The Fire Story

We generally depended upon the military and the Atomic Energy Commission (AEC) for information on nuclear weapon effects. To make sure that we kept up to date I asked the Shelter Research chief, Jim Buchanan, to be our expert on blast effects, Jack Greene, head of Postattack Research, to be our expert on fallout and radiation, and Jim Kerr of Support Systems to be our expert on fires resulting from nuclear explosions. It was the latter that raised the most questions.

The brilliant flash resulting from a nuclear explosion, called the "thermal pulse," was believed to be the principal cause of the fires that raged at Hiroshima. Of course, Japanese houses were made of paper and Hiroshima was not much like modern American cities but the potential fire threat was uncertain. The *Effects of Nuclear Weapons* had a table of materials that could be ignited by the thermal pulse. The most ignitable was old, crumpled newspaper such as you may have seen caught up in a chain-link fence. It would flame up at a thermal pulse intensity of about 5 calories per square centimeter. Anti-CD activists seized upon this datum, which could extend beyond blast damage on a clear day, drew a circle around a hypothetical explosion point, and declared all within the circle lost in the resulting mass fire.

In retrospect, our breakthrough in this area took place in the course of one of our earliest contracts. Stan Martin pointed out in his proposal that ignitions were not the same as

sustained fires. Ignitables do not usually contain sufficient energy by themselves to cause a sustained fire. What is needed is a fuel array containing both tinder and other burnables. Martin proposed to survey a suitable sample of American cities to determine the likelihood of sustained fires resulting from exterior ignitables. These detailed surveys of urban areas were carried out and found that the number of exterior ignitables that could result in sustained fires was negligible! Essentially all fuel arrays that could produce a sustained fire are in rooms within buildings.

The ignitables of interest, then, were light cotton curtains, heavy drapes, paper cartons, typing paper, upholstered furniture and beds. These have critical ignition energies of 20 to 25 calories per square centimeter, quite a bit different from the crumpled newsprint favored by the anti-CD activist. Moreover, they are in the environment of dirty windows, screens, window blinds and sprinkler systems. Quite a change! Nonetheless, we continued a major fire research effort, so major that I have devoted a whole chapter, Chapter 24, to the subject.

The Barriers to Recovery Story

One of the curious aspects of the public reaction to atomic bombs, nuclear radiation—and civil defense—was the fixation on the late effects of radiation, economic chaos and such possible consequences in the aftermath of a nuclear war. A surprising number of people seemed willing to die because their children's children might be born with some horrible defect. Herman Kahn told me he redesigned his lecture on nuclear effects to start with the genetic effects of radiation exposure and work back in time to the week of the explosion. His audiences wouldn't talk about fallout shelters until they were satisfied that the post-shelter world was worth living in. My experience at the AAAS meeting was of the same sort. One speaker alleged no one would survive, another predicted economic chaos and the third wondered if there would be human life on the planet—and these were scientists? We obviously had to tackle the uncertainties in the postattack world if the fallout shelter program was to be taken seriously.

I had made Postattack Research a major division of the OCD research program with this aspect part of my reasoning. Jack Greene, when he finally transferred over from OEP, was my pick to head the effort and he took to the task immediately. Carl Miller had prepared a research plan for the postattack period during the brief time he spent with me, which Jack began to expand. One product of his

Rita McGinley, Frances Djak, Ralph Garrett, Frank Allen, Wayne Johnson, Art Morrell, Fred Carr, Nace Meador, George Harbin